

930,928.

A. F. BERRY.
ELECTRIC SWITCH APPARATUS.
APPLICATION FILED APR. 6, 1906.

Patented Aug. 10, 1909.

3 SHEETS—SHEET 1.

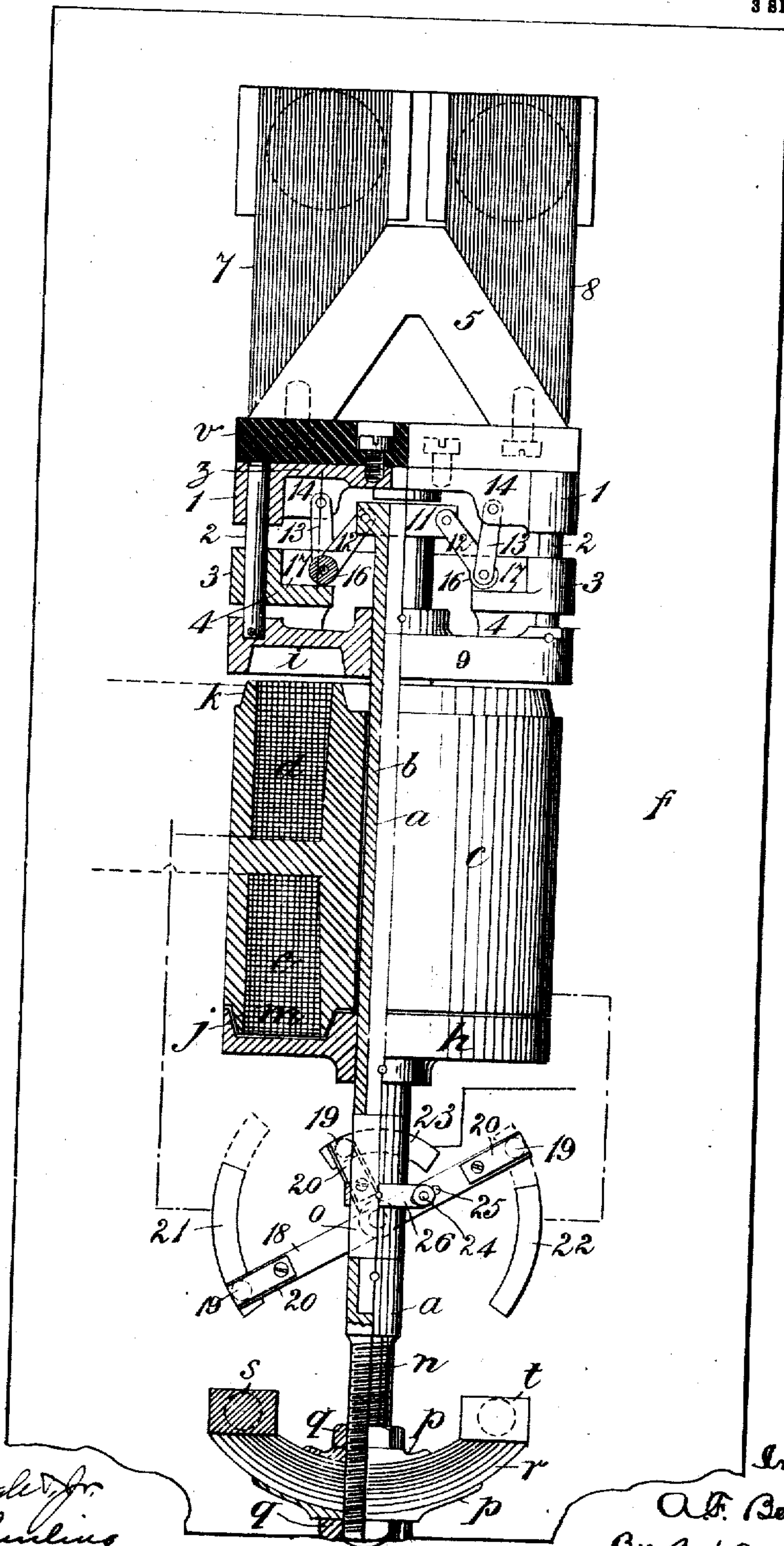


Fig. 1.

Witnesses.
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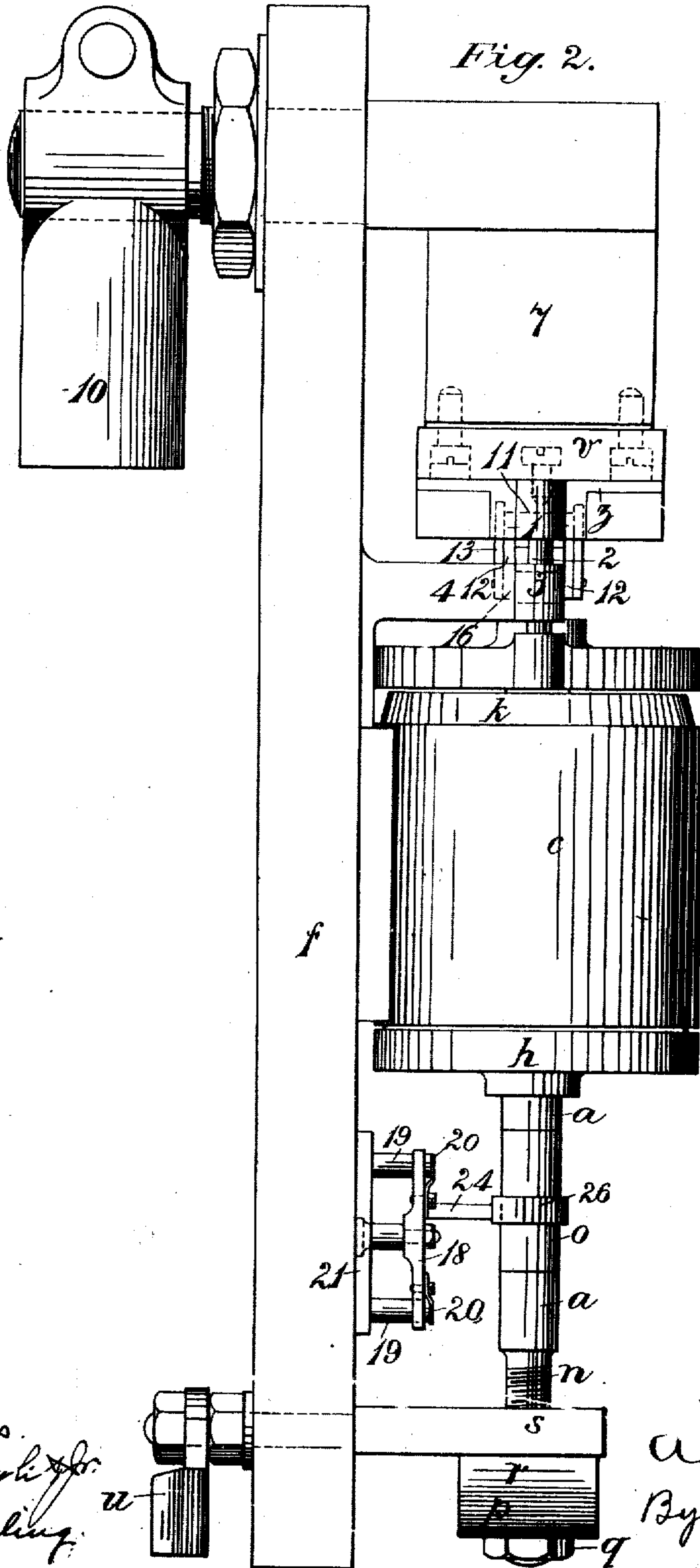
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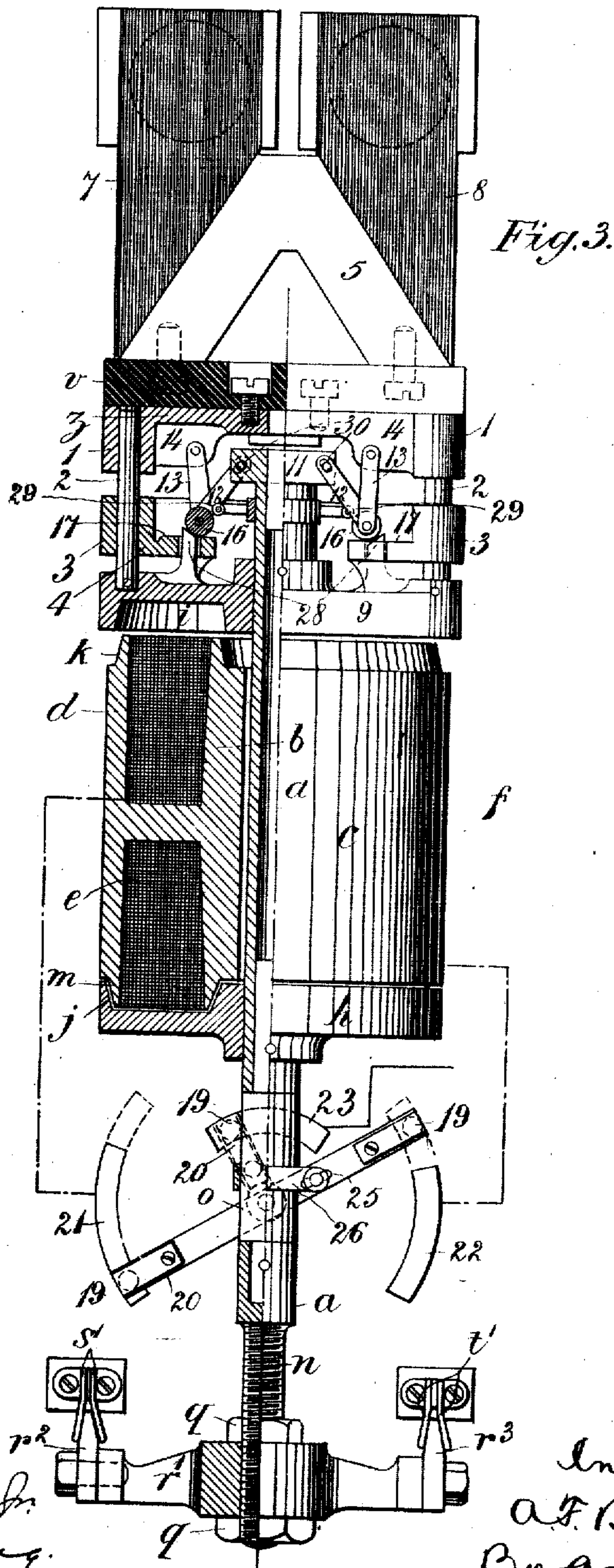
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UNITED STATES PATENT OFFICE.

ARTHUR FRANCIS BERRY, OF EALING, ENGLAND.

ELECTRIC SWITCH APPARATUS.

No. 930,928.

Specification of Letters Patent.

Patented Aug. 10, 1909.

Application filed April 6, 1906. Serial No. 310,378.

To all whom it may concern:

Be it known that I, ARTHUR FRANCIS BERRY, a subject of the King of Great Britain and Ireland, residing at Ealing, in the county of Middlesex, England, have invented Improvements in Electric Switch Apparatus, of which the following is a specification.

This invention has reference more particularly to switch apparatus of the kind comprising two or more switches designed to control simultaneously one, two, or more electric circuits, and to be opened and closed by rectilinear movements of parts carrying the movable switch contacts, and it has for objects among other things to enable the movable contact or contacts of one or more of the switches to be moved to a greater extent than the movable contact or contacts of the remaining switch or switches when the apparatus is actuated to open and close the switches; and also in some cases to enable the greater pressure exerted by the movable switch contact or contacts having the smaller movement against the corresponding fixed contacts, when the switches are closed, to balance or tend to balance the smaller pressure then exerted by the movable switch contact or contacts having the greater movement against the corresponding fixed contacts, the construction moreover being such, as heretofore, that in the act of closing the switches, the movable parts of the apparatus will assume positions in which they will become automatically locked or held in the operative or closed position against the action of gravity, or a spring, or vibration, so that they will not accidentally assume the open position but will nevertheless be free to be positively moved into the open position when required.

In a switch embodying the present invention, two movable switch contacts or two sets of movable switch contacts are carried by or connected to reciprocating parts (hereinafter called carriers) that are so connected together through intermediate connecting mechanism that when one of them is moved by electrical or other means to a given extent to open or close the switches, the other will be moved to a different extent. For this purpose the intermediate connecting mechanism may conveniently comprise sets of links, the links in each set being normally inclined to each other and jointed together

at adjacent ends and arranged to act, at their ends so jointed and preferably through an antifriction roller, against a fixed abutment, the other end or ends of one or some of the links being jointed to one of the carriers and the other end or ends of the remaining link or links being jointed to the other carrier. The arrangement is such that when one of the carriers, for example that having the greater motion, is moved endwise in one direction, the links jointed to it will cause the links jointed to the other or second carrier to turn about their points of attachment to the latter carrier and to move upon the fixed abutment and simultaneously move the second carrier in an endwise direction but to a smaller extent than that to which the first carrier is moved, each of the last mentioned links being finally moved past a line passing through its center of motion and perpendicular to the abutment so that the sets of links and carriers will be locked or held in the positions into which they have been moved, whereby accidental displacement and opening of the switches by vibration or other cause will be prevented, but the carriers can nevertheless, when desired, be readily moved in the reverse direction to open the switches.

One of the carriers may conveniently be fixed to two iron rings or plates arranged to form the two armatures of a double acting electro-magnetic device having two windings the circuits of which are adapted to be closed alternately across a source of electric energy by an electrically operated switch or relay, as in short circuiting means according to the specifications of former Letters Patent granted to me, viz. Nos. 796555 and 800538 of 1905. One of the said carriers may be arranged to actuate the movable contacts of a mechanically operated switch that is adapted at each operation of the switch apparatus to break that circuit of the winding of the electro-magnetic device which caused such operation and to close the circuit of the other winding of the said device at one point thereof in readiness to allow of its being completely closed at a second point by the electrically operated switch or relay, as described in the specification of my former patent No. 800538 of 1905.

The invention further consists in various other novel features of construction and in

combinations and arrangements of parts, all as hereinafter more particularly described and pointed out in the claims.

Switch apparatus according to this invention can be constructed in various forms.

In the accompanying illustrative drawings, Figure 1 is a sectional elevation and Fig. 2 a side elevation showing one construction of switch apparatus embodying the present invention. Fig. 3 is a sectional elevation showing a modified construction.

In the construction shown in Figs. 1 and 2, one of the switch carriers comprises a hollow vertical brass rod *a* arranged to move endwise through the hollow center of the iron core *b* of a vertically arranged electro-magnet device *c* of the kind hereinbefore referred to, provided with two windings *d* and *e* and fixed to a vertical base or support *f* of insulating material. The device *c* is provided at its ends, as before, with two movable iron rings or plates *g* and *h* that serve as armatures and are fixed to the rod *a*. Each of the rings or plates *g* and *h* is grooved on the side next to the core so as to fit the corresponding end thereof when attracted thereto, the grooves *i* and *j* in the parts *g* and *h* being preferably of truncated conical shape in cross section (as shown in Fig. 1) and the adjacent ends *k* and *m* of the core *b* being of corresponding shape. The rod *a* is provided with a lower screw-threaded end portion *n* that is connected to the upper portion through a length of insulating material *o*, and has fixed to it, between washers *p* and nuts *q*, the movable contact *r* of the switch that is designed to have the larger opening movement and which may therefore be a high tension switch. The movable contact *r* may, as shown, conveniently consist of a number of circularly bent strips of copper placed one upon another with their concave sides upmost and with their ends in a common horizontal plane and adapted, when raised, to bear against the lower flat surfaces of two stationary switch contacts *s* and *t* that are fixed to the vertical support *f* and are connected to a pair of insulated terminals one of which *u* is shown in Fig. 2. The bent strips of copper of which the contact *r* is constituted are preferably of successively increasing thickness from top to bottom.

The second switch carrier comprises a block or plate *v* of insulating material fixed to a metal plate *z*. The plate *z* is provided with tubular lugs 1 arranged to slide vertically on guide pins 2 that are fixed to and extend upwardly from the upper armature plate *g* and work through vertical guides 3 in a bracket 4 fixed to the vertical support *f*. Upon the top of the carrier is secured, by screws, a truncated A-shaped metal block 5 that forms the movable contact of a second switch, which may be a low tension switch,

and the two stationary contacts 7 and 8 of which are fixed to the base or support *f* and are connected to a pair of insulated terminals, of which one 10 is shown in Fig. 2. The stationary contacts 7 and 8 are in the form of vertically laminated copper blocks having contact surfaces inclined to each other so as to form a A-shaped space in which the corresponding A-shaped movable contact block 5 works, the stationary contacts 7 and 8 having a small degree of resiliency, due to their lamination, so that they will yield slightly when the movable contact 5 is forced against them.

The upper end 11 of the carrier rod *a*, which is wider than the adjacent portion of the rod *a*, is arranged between the carrier plate *z* and the bracket 4, and to opposite sides of it are jointed the upper ends of two pairs of links 12 the lower ends of which are jointed to the lower ends of other links 13 the upper ends of which are jointed to vertical webs 14 on the carrier plate *z*. The lower adjacent jointed ends of each set of the links 12 and 13 carry an antifriction roller 16 that bears against a horizontal abutment surface 17 on the bracket 4. The arrangement of the links 12 and 13 is such that when the carrier rod *a* is moved downward from the position shown by the attraction of the upper armature *g*, due to the completion of the circuit of the upper winding *d* of the electro-magnetic device *c*, to open the lower switch, the links 12 will force the lower ends of the links 13 outwardly past their centers of motion in the projections 14 of the plate *z* and cause the carrier plate *z* with the upper movable contact 5 to descend and open the upper switch, the extent of vertical movement of the upper movable contact 5 being less than that of the lower movable contact *r*; and when the carrier rod *a* is afterward raised by the attraction of the lower armature plate *h*, due to the completion of the circuit of the lower winding *e* of the electromagnetic device *c*, to close the switches, the links 12 will draw the lower ends of the links 13 inward past their centers of motion in the projections 14 and raise the carrier plate *z* with the upper movable contact 5, the jointed lower ends of the two sets of links finally passing inward to a small extent beyond the centers of motion of the links 13, so that the links, under the action of the upper laminated stationary spring contacts 7 and 8 will act to hold the two movable switch contacts *r* and 5 in their positions of closure. Pressure will be transmitted from one movable contact to the other through the intermediate connections. A balance between the two pressures with the links 13 in a suitable position, can be obtained by adjusting the pressure of the lower contact *r* against the corresponding fixed contacts *s* and *t* by means

of the nuts *q* and washers *p* between which it is held, the different inclinations of the links 12 and 13 to the surfaces 17 against which their rollers 16 bear, enabling the smaller pressure of the contact *r* to balance the greater pressure of the contacts 7 and 8.

By suitably constructing and arranging the links 12 and 13, the extent of movement of the two carriers and their switch contacts can be varied in any desired ratio to suit requirements.

The mechanically operated switch shown in combination with the electrically actuated switches, comprises a three-armed lever 18 pivoted to the base or support *f* and provided at its ends with contact pins 19 that are pressed endwise by blade springs 20, attached to the lever 18, and are arranged to work over insulated metal segments 21, 22, and 23 fixed to the vertical support *f*. The two segments 21 and 22 are connected each to one end of one or other of the two windings *d* and *e* of the electro-magnetic device *c* and are so arranged that the lever 18 is, at the ends of its movement, in electrical connection with only one of them at a time. The third segment 23 is connected to one pole of a source of current; and the third arm of the lever 18 is constantly in electrical connection with it through the pin 19 of the former. The lever 18 is connected by a pin 24, engaging in a slot 25 therein, to an arm 26 carried by the piece of insulating material *o* connecting the upper and lower portions of the rod *a*, so that the lever 18 will be turned in one direction when the rod *a* is raised and in the opposite direction when the rod is depressed. Consequently, when the electro-magnetic device *c* is operated to raise or lower the rod *a*, the lever 18 is moved to break the circuit through the winding *d* or *e* then energized and to close the circuit through the other of these windings so that the latter circuit is ready to be completed by the relay employed for actuating the switches at the next (reverse) operation, as described in my aforesaid specification No. 800538 of 1905.

Fig. 3 shows a modified arrangement wherein the upper armature *g* carries a pair of inclined planes 28 adapted to force the rollers 16 inward, the rod *a* carries a pair of rollers 29 adapted to force the rollers 16 outward, and the upper ends of the links 12 are connected to the upper end 11 of the rod *a* by pin and slot connections 30. The arrangement is such that when the rod *a* is moved upward by the armature *h*, the inclined planes 28 will, just before the complete closing of the switches, strike directly against the rollers 16 and move the links 13 inward past their dead centers, the pin and slot connections 30 allowing the links 12 to move upward to a small extent independently of the rod *a*, and when the rod *a* is

moved downward by the armature *g* to open the switches, the rollers 29 will strike directly against the rollers 16 and force the links 13 outward past their dead centers, the pin and slot connections 30 allowing the links 12 to move downward to a small extent independently of the rod *a*. In this way the opening and closing of the switch apparatus is facilitated. In this modified example, the lower movable contact is shown as a metal bar *r'* having upwardly extending wedge shaped ends *r''* *r'''* arranged to enter between correspondingly shaped spring contacts *s'* and *t'* fixed to the support *f*.

As will be obvious the details of construction can be variously modified without departing from the essential features of the invention.

What I claim is:—

1. Electric switch apparatus comprising two movable contacts, means whereby movement of one of said contacts will cause movement of the other of said contacts, said means comprising separate carriers for said contacts and links joined to said carriers respectively and also terminally joined together, and an abutment arranged to guide those ends of said links that are joined together.
2. Electric switch apparatus comprising two movable contacts, means whereby the movement of one of said contacts to a given extent in the direction of closure will move the other of said contacts to a different extent, said means comprising separate carriers for said contacts and links joined to the respective carriers and also terminally joined together, and an abutment arranged to guide those ends of said links that are joined together.
3. Electric switch apparatus comprising two movable contacts, means whereby movement of one of said contacts in either direction will move the other of said contacts, said means comprising separate carriers for said contacts and links joined to the respective carriers and also terminally joined together, and an abutment arranged to guide those ends of said links that are joined together, the common axis of said links being arranged to move parallel to the corresponding portion of said abutment during the opening and closing movements of said switch and to cross the line drawn parallel to the direction of motion of said contacts and through the axis of oscillation of one of said links in relation to the carrier to which it is connected.
4. Electric switch apparatus comprising two movable contact devices, two carriers to which said contact devices are connected, links joined to said carriers respectively and also terminally joined together, means for guiding said carriers rectilinearly, and an abutment device arranged to guide those

ends of said links that are jointed together, the said links being arranged so that movement of one of said carriers in one direction will move the link connected to the other carrier slightly past a dead center in relation to said abutment device.

5. Electric switch apparatus comprising two fixed contact devices, two movable contact devices, and means whereby movement of one of said movable contact devices to a given extent in the direction of closure will move the other of said movable contact devices to a different extent, said means comprising separate movable carriers for said contacts and links jointed to the respective carriers and also terminally jointed together, and an abutment device arranged to guide those ends of said links that are jointed together, the link connected to one carrier being arranged to move that connected to the other carrier across a line drawn parallel to the direction of motion of said movable contact devices and carriers and through the axis of oscillation of the latter link in relation to the movable contact carrier to which it is connected.

6. Electric switch apparatus comprising two fixed contact devices, two movable contact devices, two carriers to which said movable contact devices are connected, links jointed to said carriers respectively and also terminally jointed together, means for guiding said carriers rectilineally, and an abutment device arranged to guide those ends of said links that are jointed together, the links connected to one carrier being arranged more nearly parallel to the direction of movement of said movable contact devices than those connected to the other carrier so that during movement of one of said carriers and its contact device to a given extent in the direction of closure the links connected to the other carrier will be moved slightly past a dead center in relation to said abutment device.

7. Electric switch apparatus comprising two fixed contact devices, two movable contact devices, two carriers to which said movable contact devices are connected, sets of links arranged at opposite sides of the axis of movement of said carriers, the links in each set being jointed to said carriers respectively and also terminally jointed together, means for guiding said carriers rectilineally, and an abutment device arranged to guide those ends of said links that are jointed together, the links in each set being inclined to each other and at different angles to the direction of movement of said carrier so that movement of one of said carriers and its contact device to a given extent in the direction of closure will move the links connected to the other carrier slightly past a dead center in relation to said abutment de-

vice and will move the latter carrier and movable contact device to a different extent.

8. Electric switch apparatus comprising two movable contacts, means whereby movement of one of said contacts will cause movement of the other of said contacts, said means comprising separate carriers for said contacts and links jointed to said carriers respectively and also terminally jointed together, an abutment arranged to guide those ends of said links that are jointed together and means independent of said links for adjusting the normal distance between the movable contacts.

9. Electric switch apparatus comprising two movable contacts, means whereby the movement of one of said contacts to a given extent in the direction of closure will move the other of said contacts to a different extent, said means comprising separate carriers for said contacts and links jointed to the respective carriers and also terminally jointed together, an abutment arranged to guide those ends of said links that are jointed together, and means independent of said links for adjusting one of said contacts axially in relation to its carrier.

10. Electric switch apparatus comprising a movable contact device, a vertical carrier to which said contact device is connected, a second movable contact device, a carrier to which said second contact device is connected, a fixed abutment device having horizontal surfaces, links jointed at their upper ends above said surfaces to the upper end of said vertical carrier, links jointed at their upper ends to the secondly mentioned carrier and at their lower ends to the lower ends of the aforesaid links, means for guiding the secondly mentioned carrier vertically, antifriction rollers carried by the lower ends of said links and bearing against said surfaces, and fixed contact devices, said movable and fixed contact devices being arranged to bear against each other simultaneously and resiliently with said second movable contact device in its highest position, and said links jointed to the secondly mentioned movable contact device being caused by movement of the other movable contact device into said highest position to be moved to a small extent past their centers of motion so as, in conjunction with the resilience of the contact devices, to hold the movable contact devices against accidental movement.

11. Electric switch apparatus comprising a fixed contact device, a movable contact device, two carriers to one of which said movable contact device is connected, links jointed to said carriers respectively and also terminally jointed together, a double acting electro-magnetic device through which the second carrier is arranged to move rectilinearly and which is provided with armatures

fixed to said carrier, and an abutment device arranged to guide those ends of said links that are jointed together and permit them to be moved in one or other direction slightly past a dead center when they are operated by movement of said armatures.

12. Electric switch apparatus comprising a fixed contact device, a movable contact device, two carriers to one of which said movable contact device is connected, links jointed to said carriers respectively and also terminally jointed together, a double acting electro-magnetic device through which the second of said carriers is arranged to move rectilinearly and which is provided with armatures fixed to said second carrier, an abutment device arranged to guide those ends of said links that are jointed together so that movement of the second carrier to a given extent in the direction of closure of the switch apparatus will move each of the links connected to the other carrier slightly past a dead center in relation to said abutment device, and means operated from said armatures and arranged to act alternately in opposite directions upon the ends of the links that are jointed together and assist them to move past their dead centers when the armatures are moved alternately in opposite directions.

13. In an electric switch, the combination with two rectilinearly movable contact carriers, of an electro-magnetic device having a rectilinearly movable armature connected to one of said contact carriers, sets of links, the links in each set being jointed together at one end and some of them being freely jointed at their other ends to one of the contact carriers and the remainder being jointed to the other contact carrier, a fixed abutment device against which the ends of said links that are jointed together can act, devices carried by said armature and arranged, when the same moves in one direction, to act against and force the jointed ends of said links past their dead centers, in one direction, and devices connected to said armature and arranged when said armature moves in the opposite direction, to force the said jointed ends of said links past their dead centers in the opposite direction.

14. In an electric switch, the combination with two rectilinearly movable contact carriers, of an electro-magnetic device having a rectilinearly movable armature connected to one of said contact carriers, sets of links, the links in each set being jointed together at one end through an interposed roller and some of them being freely jointed at their other ends to one of the contact carriers and the remainder being jointed to the other contact carrier, a fixed abutment device against which the ends of said links that are jointed together can act, inclined planes carried by said armature and arranged to act against

the rollers connected to the sets of links and to move such links past their dead centers, in one direction, and means connected to the carrier fixed to the armature for acting against the rollers and moving the links past their dead centers in the opposite direction on the reverse movement of said armature.

15. In an electric switch, the combination of two rectilinearly movable contact carriers *a* and *z*, a double acting electro-magnet having two armatures at its opposite ends, said carrier *a* extending through said magnet and being fixed to the armatures thereof, a stationary abutment located between said contact carrier *z* and one of said armatures, sets of links 12—13 between said carriers, those ends of the links in each set nearest said abutment being jointed to an interposed roller arranged to work against said abutment, the other ends of the links 12 being connected by pin and slot connections to said carrier *a* and the other ends of the links 13 being jointed to the carrier *z*, inclined planes 28 carried by one of said armatures and arranged to work through said abutment and act against the rollers in an inward direction when the armatures move toward them, and rollers supported by the carrier *a* and arranged to act against the first mentioned rollers in an outward direction when the armatures move in the opposite direction.

16. An electric switch comprising upper and lower pairs of fixed switch contacts, a support therefor, upper and lower movable contacts arranged to cooperate with said fixed contacts, a horizontal plate-like carrier for the upper movable contact, a vertical rod-like carrier for the lower movable contact, an electro-magnet fixed to said support and having two windings and also two armatures arranged at its respective ends, the vertical carrier extending through said electro-magnet and armatures and being connected to said armatures, an abutment fixed to said support and arranged between the upper carrier and armature, vertically disposed sets of links connected to and arranged between said carriers, the links in each set being jointed at their lower ends to a roller arranged to work against said abutment, some of said links being jointed at their upper ends to the upper horizontal carrier and the remainder being jointed by pin and slot connections to the upper end of the vertical carrier, and means connected respectively to the upper armature and vertical carrier for assisting the lower jointed ends of the sets of links to move past their dead centers when the armatures ascend and descend.

17. An electric switch comprising upper and lower pairs of fixed switch contacts, a support therefor, upper and lower movable contacts arranged to cooperate with said

fixed contacts, a horizontal plate-like carrier for the upper movable contact, a vertical rod-like carrier for the lower movable contact, an electro-magnet fixed to said support and having two windings and also two armatures arranged at its respective ends, the vertical carrier extending through said electro-magnet and armatures and being connected to said armatures, an abutment fixed to said support and arranged between the upper carrier and armature, sets of links connecting the upper end of the vertical carrier to the horizontal carrier and arranged to co-act with said abutment as set forth, a switch lever pivoted to said support below said magnet and insulated from but arranged to be operated in opposite directions

by said vertical carrier, two fixed switch contacts connected to the respective windings of said magnet and over which said switch lever works so as to bear against only one or other of them when it is at the end of its movement in one or other direction, and a third fixed contact that is in constant connection with said switch lever and is adapted to be connected to a source of electrical energy.

Signed at London England this 26th day of March 1906.

ARTHUR FRANCIS BERRY.

Witnesses:

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